TROPICAL AGRICULTURE

THE OFFICIAL JOURNAL OF THE
IMPERIAL COLLEGE OF TROPICAL AGRICULTURE

VOL. II No. 1. TRINIDAD, JANUARY, 1925. PRICE 6d.

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TROPICAL AGRICULTURE is published at the Imperial College of Tropical Agriculture, St. Augustine, Trinidad, West Indies, at the end of the third week of the month preceding the one of issue. Advertisement rates can be obtained at the College from the Editor, or from the Secretary of the College, 14, Trinity Square, London, E.C., England. The Editor will be glad to consider authoritative articles for publication. It is understood that opinions expressed in signed articles are those of the author and do not necessarily represent the policy or opinion of the College Authorities. Correspondence, which will be replied to, is invited on all matters pertaining to tropical agriculture, science and development.

TROPICAL MEDICINE.

"We cry, "God, make us Kings,
Poets and Prophets here!"
The scornful answer rings
"First be my Scavenger."
(Ross "Memoirs.")

WE referred briefly last month to those great needs of the tropics, namely, advertisement, capital, and European energy, and we ventured the opinion that, the British Empire Exhibition having given the necessary advertisement, capital and European energy would eventually follow. Important though advertisement and capital are, there can be little doubt that ultimately the question of man power is the fundamental problem of the tropics, for, no matter how rich the resources of the tropics might be, they would inevitably have remained unexploited unless adequate and efficient labour was available to work them. It is only recently that the tropics were regarded as anything but the "white man's grave" and it must be confessed that this opinion is still very widely entertained. We share the opinion of Prof. J. W. Gregory (see "*Trop. Agr.*" Vol. I No. 10 p. 164.) that the abnormal sickness and death rate in the tropics was due, not so much to unalterable factors of climate, as to the abnormally unhealthy conditions under which Europeans had to live. That eminent tropical administrator Sir Frederick Lugard wrote, "I have served with short intervals for forty years in the tropics, mostly in places with the worst climatic reputation and I think that the appalling death-rate in those early years in West Africa was due not so much to the climate, as to the absence of the necessary housing, &c., and that the death roll would have been hardly appreciably less had we lived in the Thames valley all the year round in the same conditions of overwork, anxiety, housing and food." We are in general agreement with this eminent authority, and there is no doubt that when medical science in temperate zones was considered largely an occult science, the death-rate in European countries must have been as prodigious as it was in the tropics at the end of last century. Epidemic and pandemic diseases swept Europe and decimated the population at fairly frequent intervals, simply because no means had been discovered to check their terrible ravages. Even during the reign of Charles II "The Great Plague" was allowed to levy an enormous toll upon the population of London and was arrested only by that blessing in disguise, "The Great Fire."

The science of tropical medicine was in a similarly parlous state even towards the end of the 19th century. Dr. Horton writing of the West Coast of Africa in 1867 said, "Not only has the the European on leaving home the melancholy, foreboding of a speedy termination of his existence, but his friends, or relatives also reckon him from the day of his embarkation as amongst the dead." Under such circumstances the development of the tropics must of necessity have remained a tedious and expensive affair. One reads, for example, of the terrible levy upon human life in West Africa when the requirements necessary to fill the vacancies caused by the absence of Government officials on leave in England amounted to one-third of the total establishment, while if the deficiencies due to invalidings, extensions of leave on account of ill-health, and local absence due to the same cause were added, we find that

the effective strength was only 50 per cent. or, in other words, it was necessary to maintain an establishment twice the size of normal requirements. Bruce (" *Crown Colonies and Places.*" Vol. I p. 403) quotes a case where the Colonial Governor who signed a despatch, the Secretary who wrote it, and the clerk who copied it, all died before it reached the Colonial Office from the Coast. The result from the administrative point of view was little short of disastrous, since it rendered efficient government impossible, squandered much of the best youth of the country, and deterred many brilliant young men from embarking upon a career which apparently offered no other prospect than a speedy termination of life.

Apart from the appalling wastage of life there was the terrible lack of efficiency engendered by the effects of tropical diseases, Sir Bamfylde Fuller wrote: " Whatever may be the effect of the Indian climate, there can be no doubt of the enervating and exhausting influence of malaria by which the country is pervaded . . . Over many parts of the country the inhabitants are saturated with malaria, and its prevalence accounts no doubt for much of the apathy and listlessness which deaden the spirit and industry of the people. Fever denies India a chance of being industrious." (Sir B. Fuller, *The Empire of India* p. 323). It was officially estimated that in India about 1,300,000 deaths were caused by malaria in years when the disease was not exceptionally prevalent, while of 300,000 men in the army in India, 100,000 were admitted into hospital every year for malaria. That great teacher of Economic history, Professor Knowles, to whom we are indebted for many of the facts here quoted, ventures the opinion that Africa was kept in the dark ages through the effect of malaria in stunting the mentality of the children, with the result that material prosperity was paralysed.

" Malaria " occurs most of all in the richest and most fertile tracts of the world, it is the enemy of the pioneer, the traveller, the planter, the engineer and the soldier. It may safely be maintained, not only that many important undertakings and industries in the tropics have been ruined by it, but that the progress of whole countries, some of which possess the greatest natural resources, has been retarded in consequence of this pernicious malady." (Ross: *Proceedings R. C. I.* Vol. XXXV pp. 7-8).

Sleeping sickness, liver abscess, dysentery, yellow fever, beri-beri, elephantiasis, hook-worm and other tropical scourges, all levied relentless toll upon the lives and energy of the native and European population. In the Madras Presidency even within recent years it was estimated that little short of 100 per cent. of the rural population was infected by hookworm. Over 70 per cent. of the tea garden labour force of Darjeeling was infected, and a similar state of affairs prevailed in Bengal (see *Indian Industrial Commission.* Cmd. 51 (1919) p. 461). The total number of wage earners in India affected by hookworm probably exceeds 45 million and, since the disease reduces efficiency by as much as 25 per cent. to 30 per cent. it will be seen that anyone who could eradicate this single disease would add enormously, not only to the numbers of wage earners, but also to their individual efficiency. Major White, Sanitary Commissioner for India stated that, " A thorough hookworm campaign offers perhaps the best opportunity of effecting a rapid improvement in the Health conditions, and consequently the efficiency of our labour forces."

These were the factors that earned for the tropics the unenviable reputation of being the " white man's grave." Meanwhile patient and effective work was being accomplished by doctors and officials scattered throughout the tropics. They laboured courageously under appalling conditions, with scant recognition either from the authorities on the spot or at home. It is largely to their self-sacrifice that we owe the enormous improvements that have recently taken place in tropical medicine and sanitation. Effective means of combatting tropical diseases received a magnificent advertisement through the American success against yellow fever during the construction of the Panama Canal. It was demonstrated that, provided reasonable precautions were taken, man need no longer be the slave of the insect. The International Health Conference of the Rockefeller Institute was instrumental in inaugurating an anti-hookworm campaign.

In 1895 Mr. Joseph Chamberlain deliberately jeopardised his political future by taking the office of Secretary of State for the Colonies, then a minor post in the Cabinet, and among other things he recognised the immediate necessity of adopting means of rendering the tropics reasonably healthy for the white and coloured population. It is due largely to his sympathetic foresight that we owe the establishment of an adequate and efficient medical service in the tropics, and the construction of schools of tropical medicine. In 1899 a school of tropical medicine, subsidised by the Imperial Government and the Crown Colonies, was opened in London and, at the dinner given to celebrate its inauguration, Mr. Chamberlain said, " The man who shall successfuly grapple with this foe to humanity and find a cure for the fevers depleting our colonies and dependencies in many tropical countries, and shall make the tropics livable for white men, who shall reduce the risk of disease to something like the ordinary average, that man will do more for the world, more for the British Empire, than the man who adds a new province to the wide dominions of the Queen." Another school of tropical medicine was opened in Liverpool in 1899 by funds generously contributed by West African merchants. In addition the Colonial Nursing Society was formed in 1876, by private subscription, for the purpose of supplying trained nurses, and permanent medical research laboratories were instituted in the Crown Colonies.

In this manner a comprehensive medical campaign was begun during the 90's and the efforts of these bodies, combined with more efficient administrative control, enabled astounding results to be achieved within a remarkably short period of time. The mosquito was discovered to be the agent by which many of the most deadly of tropical diseases were distributed. Sir Patrick Manson for example, found that elephantiasis was tramsmitted by mosquitoes while Sir Ronald Ross, in 1897 determined that a mosquito (*Anopheles*) was the intermediate host of malaria. Subsequent research revealed the fact that yellow fever and many other tropical diseases were spread by these and other blood-sucking insects. Acting upon this knowledge the Americans conducted a determined campaign in the Panama Canal Zone with the result that the 10,000 workers there were enabled to enjoy as good health as they would have done in America. Yet the French are reputed to have lost 50,000 men in the attempt to construct the canal, and Surgeon-General Gorgas legitimately claimed that the results achieved in Panama "will be generally received as a demonstration that the white man can live and thrive in the tropics." The elaborate methods of attacking the breeding grounds of mosquitoes, and the precautions taken against being bitten, resulted in a considerable decrease in the rates both of mortality and sickness. Extraordinary masses of statistics, of which the following may be taken as being typical, might be quoted to prove that with adequate medical precautions the tropics can be made as healthy as many European cities.

The invaliding rate for European officials in West Africa dropped from 60·3 per thousand in 1903 to 25·2 per cent. in 1911, while the deaths among the native troops declined by 75 per cent. between 1882 and 1922. In the Federated Malay States no less than 334 patients from Klang and Port Swettenham were admitted into hospital in 1901 as serious cases of malaria, and the situation became so critical that the question of abandoning the port had seriously to be considered. After drainage had been undertaken the admissions dropped to an average of 29. The number of admissions into hospital for malaria in Hong Kong in 1901 was 1,294 but as a result of the campaign begun in that year the admissions fell to 419. In 1902 the Suez Canal Company requested Major Ross to investigate the extraordinary amount of sickness in Ismalia. The result was little short of miraculous. In 1900, no less than 1,284 cases were notified yet in 1906 not a single case was recorded ! In Calcutta the death rate for British and Indian troops fell from 20·37 per cent. and 19·93 per cent. respectively in 1875, to 4·35 per cent. and 4·39 per cent. in 1914. Similar progress can be recorded in regard to most other tropical diseases.

While it is gratifying to record this rapid improvement in the general health of people living in the tropics, it cannot be over-emphasized that success or failure depends ultimately upon the people themselves. It has been abundantly demonstrated that where full co-operation between the medical officer and the people exists, astonishing results can be achieved in raising the general standard of health, efficiency and well-being of the population as a whole.

In this small island of Trinidad, the Rockefeller Foundation of the International Health Board is winding up a ten years' campaign against hookworm. Remarkable improvements are already noticeable. The ease with which the disease can be diagnosed and treated has been clearly shown, but the importance of this work lies, not so much in the actual numbers treated and cured as in the stimulus given to others to carry on this noble work after the medical officers responsible for inaugurating the campaign have left the Colony. Planters and others directly employing labour should realise, as many of them do, that there is not merely a financial but also a moral duty to see that their labourers are kept in a satisfactory state of health.

What is true of the hookworm campaign in Trinidad is also true of other countries and other diseases, and we confidently anticipate that all concerned will act as Crusaders in this magnificent cause. Tropical medicine and Sanitation mean progress, civilization and prosperity for the various races inhabiting these areas. The work of those zealous medical pioneers of the 19th century and of the various schools of tropical medicine is epitomised by the ever-growing importance of the tropics in world economics.

EMPIRE SUGAR.

SIR FRANCIS WATTS, K.C.M.G., D.SC., *Principal Emeritus.*

The production of sugar for the English market was for a long time the particular function of the West Indies, a position which obtained until the early part of the nineteenth century, when owing to the great increase in the production of beet sugar in Europe and the expansion of sugar production in other parts of the world, less and less dependence on West Indian sugar resulted, until, at the present day the West Indies only furnish some five per cent. of the requirements of the United Kingdom.

The production of sugar became of fundamental importance to the British West Indies very soon after their settlement. While the sugar-cane was known to the earliest English settlers its cultivation was not of immediate importance, for the art of sugar making was unknown and the sugar-cane was only grown in order to furnish refreshing drinks or for other unimportant purposes, the principal crops of the early settlers, in addition to those which they grew for purposes of food, being indigo, tobacco, cotton and ginger.

English colonisation in the West Indies dates back to 1623, when English settlers first occupied St. Kitts. Barbados was settled very shortly afterwards in 1625; and it was here that the British sugar industry took its rise.

Information as to the manner of making sugar reached that colony somewhere about the year 1640 through a Dutchman who arrived there from Brazil; at first the secrets of the art were but imperfectly understood, so that for the first few years the amount of sugar made was inconsiderable and the quality poor. In order to obtain better information, enterprising planters from Barbados undertook repeated journeys to Brazil, thus learning more accurately the correct methods of sugar making; this led to such success that the industry made rapid strides and sugar soon displaced indigo, tobacco, cotton and ginger as principal objects of cultivation on the plantations.

Much interesting information concerning the cultivation and manufacture of sugar in Barbados is given by Richard Ligon, who resided in that island for about two and a half years, between 1647 and 1650, by the latter year the process of manufacture was so well understood that, not only were ordinary muscovado sugars produced, but clayed white sugar was also made in some quantity. The sugar thus produced became a notable and valuable commodity in the English market and laid the foundation of the valuable industry of the next two centuries. So immediate was the success that the value of land in Barbados increased enormously and Ligon tells us that in 1648 Colonel Thomas Modiford willingly paid £7,000 for one half of Colonel Hilliard's plantation the whole of which could have been purchased for £400 prior to the introduction of sugar growing.

The art of sugar making was introduced into Jamaica by Sir Thomas Modiford in 1664, and into Antigua and the neighbouring islands by Colonel Codrington, when he removed from Barbados to Antigua in 1674.

Thus were laid the foundations of the British West Indian sugar industry, an industry destined to become of national importance.

Up to the end of the eighteenth century the British West Indies constituted the principal source from which the sugar supplies of Great Britain were derived. But about the beginning of the nineteenth century the beet sugar industry took its rise and its developments were so phenomenal that by the middle of the century it was competing extensively with British grown sugar in the home markets, and long before the end of the century Great Britain became almost entirely dependent on supplies of beet sugar produced on the continent of Europe under State aid of the most carefully calculated character; thus British West Indian sugar became of relatively little importance to consumers in Great Britain and was largely forced to find markets elsewhere.

With the increased production and keen competition, sugar became remarkably cheap, so that, from being an article of luxury it passed by easy stages to the position of a food material of very great importance. It is doubtful whether the consuming public or the statesmen of Great Britain were conscious of this material change in outlook, but it was an important one, and one which fitted in remarkably well with the profound industrial changes that were taking place in England. At this time the rapid rise of manufacturing industries was taking place owing to the development of the use of steam power; the energies of the nation were directed towards industrial enterprises and the population of the country was increasing rapidly, but less attention was being paid to English agriculture and the production of home grown food supplies, increased reliance being placed on imported foods. At this juncture, owing to its increasing abundance and cheapness, sugar, from being a luxury, developed into an important article of food, so that to-day it occupies a position of importance in the national economy comparable with that held by wheat and meat. It is questionable whether this is fully recognised by the people of Great Britain or whether they realise the consequences resulting from this.

Unfortunately with this increased importance and changed relationship the control of sugar production passed largely from British hands. It is true that the British West Indies continued to produce sugar much as before, but it was largely diverted from the markets of the Mother Country; at the same time the production of West India sugar failed to keep pace with the enormously increased production of other countries and so became of relatively small importance in regard to the world's supply, though remaining of vital importance to the West Indian colonies themselves.

It is unfortunate that these great developments took place in foreign countries, largely on the continent of Europe in connection with the State fostered beet sugar industries of several countries, and in countries under American and Dutch influence, including Cuba, Porto Rico, Hawaii, the Philippines and Java. British colonial sugar, regard being had not only to the West Indies, but also to other tropical British colonies, failed to make corresponding progress in sugar production for, being without State aid, they were unable to meet the competition of countries whose statesmen, recognising the value and importance of a sugar industry, afforded carefully calculated State assistance. This assistance took various forms, including direct and indirect bounties and protective tariffs. Under this stimulus the production of sugar in foreign countries became enormous and, before the great war, the United Kingdom obtained abundant supplies of foreign sugar, often at prices below the cost of production.

Had sugar remained an article of luxury this position might be viewed with equanimity, but in the altered relationship, where sugar now occupies a vital position as an important article of food, it is by no means satisfactory that there should be this large dependence on foreign supplies and it would be wise statesmanship to abandon

the attitute of *laisser faire* and to take such steps as may lead to larger and larger proportions of the sugar supplies of Great Britain being produced in British possessions. The time appears ripe for such a movement, if it can only be realised that considered and concerted action is necessary to take advantage of it.

With the revival of industry throughout the world, which may be looked for during the next few years, it is probable, nay certain, that populations will increase and that their purchasing powers will increase too, and that larger supplies of sugar will be needed, if sugar can be given the place in national economics and politics which its importance warrants it should not be difficult to devise means whereby a large proportion of the sugar required by Great Britain and her dependencies the world over may be produced in British possessions. Such an ideal involves an Imperial movement; it means something much more than a West Indian one and it should include not only the cane sugar production of the tropical possessions, but also the production of beet sugar in temperate regions of the Empire.

It is very desirable in the interests of the Mother Country, the Dominions and Colonies that such a development should now be deliberately planned and fostered and it is eminently fitting that matters pertaining to sugar and sugar production should be an important feature in the work of the newly founded Imperial College of Tropical Agriculture; furthermore, it is important to recognise that the Sugar School of the College is the first institution of its kind in the British Empire to be equipped with an experimental sugar factory of remarkable completeness and with adequate means of teaching sugar technology and that, so equipped, the College should be able adequately to assist in training and providing men to carry out the contemplated work of British sugar production, and thus play a leading part in Empire development which has been too long delayed.

SIR FRANCIS WATTS.

An Appreciation.

PROF. O. F. BOYD, B.A.

THE growth of scientific education and scientific methods of cultivation and manufacture of farm products has been very gradual throughout the West Indies. The necessity of a scientific and technical control over agricultural conditions and farming methods is realised universally to-day, although there are many who continue to adhere to the old traditions and methods.

This realisation of the value of science was not brought about, however, in any short length of time, nor by any particular event, but the process has been one of evolution and progress, and would cover a period of perhaps three-quarters of a century.

In looking back over this era of growth, one is confronted with the life histories of the pioneers of science who have devoted their lives to the cause, and carried on in the face of hardships and adverse conditions.

Foremost among these pioneer scientists stands Sir Francis Watts, K.C.M.G., D.SC., who no doubt has done more toward bettering agricultural and farming conditions in the West Indies than any of his colleagues. He has devoted his entire life to the cause of science, and has been rewarded by seeing his numerous schemes and suggestions for improvements result in a practical and financial success. His contributions to the betterment of agricultural methods are numerous, and in almost every case have been successful and are a direct help to estate and factory owners throughout the world.

Dr. Watts's first appointment was the post of Government Chemist in Antigua, the Capital of the Leeward Islands. In Antigua his work was mainly directed toward the study of various varieties of the canes, local soil conditions, and the problems which these two fields of study presented as to fertilisation and the selection of varieties best adapted to the local soil and climatic conditions. Sugar was manufactured during this period by the crudest methods and the final product was what is known as muscovado sugar, a very dirty molasses sugar. A large percentage of the sugar was lost in the megass and the extraction of juice was very low. Dr. Watts studied very closely the methods of manufacturing muscovado, and found them to be crude and wasteful, and came to the conclusion that it would be better for all parties concerned to organise and erect a central factory which would operate with modern methods and modern machinery. To this central factory the estate owners and cane growers would send their cane and an agreement or basis of payment could be arrived at. This proposal or suggestion was made to the estate owners in Antigua, but did not meet with approval. After several years had elapsed, however, the idea was again taken up by a group of English capitalists and a small central factory was erected at Gunthorpes in Antigua, to which the estate owners had agreed to send their canes. This was the first central factory to be established in the British West Indies. Its success was immediate and its establishment was followed by others throughout the West Indies. Dr. Watts was largely responsible for the idea of the centralisation, and it was through his efforts and literary contributions along the subject that the plan was eventually carried out.

In May, 1898, Dr. Watts was selected for the post of Government Chemist in Jamaica. Although he remained there only a short time he contributed greatly to the needs of the planters, advising them as to soil and agricultural problems, and has visited the Island several times since and given advice when needed. It was upon his return from Jamaica that Dr. Watts was appointed Superintendent of Agriculture for the Leeward Islands, in connection with the newly established Imperial Department of Agriculture. The post of Government Chemist was also included in the appointment. It was during this period that he became interested

in the re-establishment of Sea Island Cotton as a resource in the West Indies. His contributions to the literature and scientific journals concerning this product received widespread attention, and assisted largely in the re-establishment of the industry.

In January, 1909, Dr. Watts was appointed Imperial Commissioner of Agriculture for the West Indies with headquarters in Barbados, and the department was afterwards moved to Trinidad. He was knighted in 1917, as a recognition of his services to the Empire.

The establishment of the Imperial College of Tropical Agriculture was effected in 1921, and the post of Commissioner of Agriculture was combined with that of Principal of the College. Sir Francis was largely instrumental in the establishment of the College, and made numerous appeals and proposals to the various Governments and Presidencies, pointing out the benefits which might be derived from an Agricultural College in the West Indies. The College is now located at St. Augustine, Trinidad, and is doing splendid work along agricultural lines. Students are enrolled from various islands throughout the West Indies, and several post-graduate students have come out from English Universities to study tropical agricultural conditions. The beneficial results of the College are obvious and it is a great aid to the agricultural world in contributing results of experiments and research work.

Sir Francis has been more interested in the sugar industry than in any other branch of agriculture, and is the author of many valuable articles upon the subject. He has also written a book upon the manufacture of sugar which was published several years ago. Keenly interested in sugar he urged the establishment of a department of Sugar Technology in the College and this has been accomplished.

The department of Sugar Technology is peculiarly fortunate in having an experimental factory at its disposal for research and experimental work. This factory is largely the gift of British manufacturers of sugar machinery and Sir Francis was directly responsible for its erection. The splendid opportunities for research and investigation in a department so well equipped are easily recognised, and the factory will be a lasting tribute to his efforts in the interest of education.

Sir Francis retired from the active principalship of the College and as Imperial Commissioner of Agriculture on October 31, 1924, and was succeeded by Dr. H. Martin Leake. He was made Principal Emeritus and continues to live in Trinidad. The importance and scope of his contributions to science and education cannot be over-estimated and will live for many years hence. One might safely say that the name of Francis Watts has been synonymous with progress and science, and his career in the West Indies has set a splendid example of diligence and steadfastness of purpose to guide other scientists who might follow him.

AGRICULTURAL RESEARCH.

(" CANTAB." AND SIR JOHN RUSSELL, D.SC., F.R.S.)

Under the 'nom de plume' of 'Cantab.,' a writer in "Nature" (No. 2865, Vol. 114, 1924) offers some criticism of the Presidential Address of Sir John Russell to Section M (Agriculture), at the meeting of the British Association at Toronto. After a reference to the results of Scientific research he continues :—

Why is it then, that, as judged by economic tests, farming practice has been so little modified that even Virgil's " Georgics " may still be read as a textbook ? One reason may be suggested. The growth of a plant or animal is affected by a number of environmental causes beyond the human control. A severe hailstorm, a rainy season, may render nugatory all the efforts of the most skilful and scientific husbandman. He earns his living really by virtue of the law of averages. If old tradition is right, he rings a cycle of changes in a lunar period of nineteen years. It is a fair inference, therefore, that he is not likely to be much moved by scientific evidence that a certain course of action will produce a better result *of the order of difference* that he associates with a normal seasonal variation. If for example, the supposition is made that the yield of any crop on a particular field will vary normally by 10 per cent. from year to year, a scientific improvement, which if adopted increases yield by 10 per cent. in any one year, is scarcely likely to interest the husbandman. It may be, therefore, that science has failed to produce discoveries of sufficient magnitude. " Artificial " manuring, it is true, may be said to have been a discovery of the order of 100 per cent. and the science of plant breeding may be said to have involved differences of the same order.

In Sir John Russell's address consequently, one detects a feeling of disappointment. We have passed through, he says, a "pioneer period with . . . the disadvantages of certain lack of perspective, failure to follow up important issues, and some narrowness of outlook." He suggests that steps should be taken to secure the co-operation of a team of workers in every science bearing on agriculture—the members to be drawn from all parts of the British Empire. The proposal is scarcely in the region of practical politics. After all, the epoch-making discoveries of science have not come from team work—nor from what is sometimes termed " directed " research.

The whole history of scientific effort, is a ecord of individual successes in so-called " pure " science, and, with due respect to the Director of Rothamsted, what appears to be wrong with agricultural science is that it is too agricultural. If, as he says, the " co-operation of a plant physiologist " is needed, let us take care that the worker is not tied to the study of agricultural plants, and if, in consequence, he is a worker in " pure " botany, let us see that he gets as liberal a grant as his brother working in agricultural botany. At the present juncture, research in pure botany is languishing in all our universities,

and yet, on Sir John Russell's admission, the advances made by one branch of the science, that of plant-breeding, have far outdistanced any discoveries in the sciences with which he is directly concerned.

Sir John Russell replies ("*Nature*," No. 2870, Vol. 114) as follows :—

I had no intention of being despondent in my address to Section M (Agriculture), nor is there occasion for despondency. It is true that science has given only few aids to agriculture of the order of 100 per cent. increase in yield, but much has been done of a less spectacular nature, and agricultural experts are now able to advise farmers with considerably more certainty than was the case even thirty years ago. There have been great changes in practice, and science has helped considerably.

The history of agriculture shows that advances have come in three ways : from purely empirical methods tried by farmers with no definite scientific plan ; from experiments on empirical lines made by trained workers : and from advances in pure science, whether initiated in a purely scientific or, as has often happened, in a technical laboratory. It is a fact that in the past some of the biggest advances have been made by empirical methods but one cannot infer that scientific methods are therefore inferior ; only in recent years have they been adequately tried. Our knowledge of the biochemical changes in the soil, of the soil micro-organisms, the soil solution, and the soil colloids quite apart from the genetical work to which "Cantab" referred, has all come as the result of purely scientific work, done solely with the view of gaining information, and with no idea of practical applications. Little of this knowledge is yet used in practice, for the simple reason that no one has found a way of using it, but all history shows that the application comes sooner or later once the scientific discovery is definitely established. There is every reason to hope that agricultural science has fresh triumphs in store.

In recent years it has been easier to apply scientific methods in agricultural investigations because many of those responsible for the management of agricultural institutions, and especially the younger men, appreciate their value and realise the necessity for the so-called "academic work." No honest person working on scientific lines would ever commit himself to a definite promise that a particular investigation would have practical results ; he can, however, so conduct it that it will yield sound knowledge. It is of course true, as "Cantab" points out, that epoch-making discoveries have not yet come direct from team work or directed research. But it must also be recognised that advances of this order are in any case very rare, and when they come it is largely as the result of the less spectacular but none the less real, advances in knowledge which can be made in the well equipped organised institution. No research institution can do more than hope for first order discoveries, but the staff can, at any rate, ensure good development work, and secure advances which in the aggregate count for much.

Like all other forms of research, agricultural research is finally limited by the state of knowledge of other branches of science ; and a logical scheme of assistance would recognise the claims of all pure science. The present schemes may not be very logical, but knowing something of the methods by which a research institute has to be sustained, I am not sure that the departments of pure sicence have always adopted the best methods for obtaining assistance. A great difficulty of research institutions—and it must be far greater to the layman—is to know just what are the methods and the results of science, in other words, whether the limitation imposed by lack of knowledge in pure science lies in the man or the science. The agriculturist investigator received his training in pure science it may be ten or twenty years ago ; he tries to keep up, but is overwhelmed by the enormous and ever-increasing volume of papers of very varying merit and lucidity. The Chemical Society facilitates his task by issuing annual reports on the different branches of chemistry, but many other scientific societies have not followed this good example. There must be many papers in pure science buried in the libraries which would prove of great value to agriculture if they were known but they are not. At Rothamsted we have adopted various devices for keeping in touch with pure science, one of the best of these being to bring young men and women from the purely scientific laboratories from time to time to take part in our work. This is one example of the "team work" to which I referred in my address as being among the hopeful ways of securing advances in agricultural science, another being co-operation between institutions engaged on different aspects of what may be fundamentally one and the same problem.

Team work makes it possible for the different workers to keep in touch, and to utilise advances made in other subjects. It has other advantages too, for even the wisest of mortals will never see a scientific problem as a whole, but only in part.

"PHOTOPERIODISM."

Another Physiological Aspect of Fruit-Production.

In extension of the remarks on the carbohydrate/nitrogen ratio in plants, which appeared in the last number of this Journal, special reference must be made to recent work on the effect upon plants of altering the daily period of light to which they are subjected.

The idea of experimenting with increased or diminished periods of light is not in itself at all new in physiological research, but a new viewpoint was given to such enquiries by W. W. Garner and H. A. Allard in a paper on "Effect of the

Relative Length of Day and Night and other Factors of the Environment on Growth and Reproduction in Plants" (*Journal of Agricultural Research* Vol. 18, pp. 553-606 : 1920.) These workers emphasized the *relative* length of day as a factor of the first importance.

"Short days" were provided by placing the experimental plants for a certain period each day in a dark chamber, ventilated so that temperature and moisture conditions should be altered as little as possible; "long days" by the use of electric light after nightfall.

After experiments with a considerable number of species and varieties, Garner and Allard concluded that for each there is a definite length of day which favours reproduction; this they call the "photoperiod" of the plant, suggesting the term "photoperiodism" to designate the response of organisms to the relative length of day and night.

It was found that "exposure to a length of day unfavourable to reproduction but favourable to growth tends to produce gigantism, or indefinite continuation of vegetative development, while exposure to a length of day favourable alike to sexual reproduction and to vegetative development, extends the period of sexual reproduction and tends to induce the 'ever-bearing' type of fruiting."

The application of these results to the problems of natural distribution of plants is interesting. At the Equator the days are always twelve hours long, whilst toward the Poles seasonal fluctuations in day-length become more and more marked. Evidently a plant which requires a day of more than twelve hours to initiate reproduction could not survive near the Equator, whereas, given the right conditions of temperature and water-supply, it might do well in higher latitudes. This is a point to be borne in mind when attempts are made to acclimatise plants from temperate regions in the Tropics. In some cases the shorter days may inhibit flowering altogether, in others the reproductive phase may be initiated before the plant has made sufficient vegetative growth to enable it to support a crop.

In temperate regions much depends upon the selection of the correct sowing date, since maximum yield will be given when the crop in its young stages enjoys lengths of day favourable to vegetative growth, and later on, when good growth has been made, is subjected to days favourable to reproduction.

Within the Tropics, with the hours of daylight varying but little, it might be expected that sowing date is relatively unimportant from this point of view, but it has just been shown that such is not the case. T. B. McClelland ("The Photoperiodism of Tephrosia candida," *Journ. Agric. Res.* Vol. 28, pp. 445-460 : 1924) worked in Porto Rico, where the time from sunrise to sunset varies only from 11 hours in December to 13·2 hours in June. Duplicate rows of Tephrosia candida were sown at intervals of 14 days throughout a year, and it was found that there was only one blossoming season. With a day-length favourable to blossoming practically all plants as old as six months, and a number only four and a half months old, flowered. Plants much younger than four and a half months at the blossoming season will not only pass the first season without flowering, but will also not develop flowers until the return of the right day length the following year. Dr. S. C. Harland has observed the same kind of behaviour in pigeon peas (Cajanus indica) in the West Indies.

McClelland also found, by experiments with controlled lengths of illumination, that the flowering of Tephrosia was inhibited both by a day shortened to 10 hours, and by one of 13·2 hours; shortening the summer day artificially to 12 hours promptly induced flowering. It is therefore demonstrated that even the relatively slight fluctuations of day-length within the Tropics are important.

The question naturally arises, whether the effects of photoperiodism can be correlated with the carbohydrate/nitrogen theory of reproduction. Garner, Bacon, and Allard (*Journ. Agric. Res.* Vol. 27, pp. 119-155 : 1924) advance results which indicate that they can. It is shown that the daily light period may determine not only the quantity of carbohydrate produced, but also the utilization of this material, and furthermore that it may also influence the water-content of the tissues—another factor of importance in reproduction, as the well-known burst of flowering in many species in the dry season indicates. Further work along this line should be of great interest.

E. E. C.

SEED-BORNE DISEASES.

PROF. S. F. ASHBY, B.SC.

It is well known that a number of injurious fungous and bacterial diseases can be and have been introduced into countries and spread in them by means of living plants and their vegetative organs used for propagation. On account of this risk many civilised countries prohibit the import of such material or subject it to careful inspection and disinfection. The trade in seeds for propagation, on the other hand, has been allowed to go on to a large extent unrestricted partly owing to the difficulty of disinfection without seriously impairing germination but also because it was not generally known that highly injurious fungous and bacterial diseases could be commonly transmitted in or on seeds. The smut diseases of cereals were a recognised exception but effective means had been found of disinfecting seed contaminated externally by smut spores, and even seeds where the infection was internal and the treatment had become a part of agricultural practice.

Of recent years, however, investigation has steadily increased the number of diseases of cultivated plants transmitted by seeds and according to Dr. C. B. Orton, the American Phytopathological Society and Crop Production Institute have compiled a list of at least 160 fungous and bacterial diseases now known or strongly suspected to be carried by seed. The United States Quarantine Act of 1919 was the first attempt to impose inter-state restriction on the free movement by the mails of seeds infected by certain diseases. It is probable that such restriction will be extended and become international in scope. It is certain, if not in every case formally proved, that the great majority of the fungous and bacterial diseases of cultivated plants propagated by seed have in the first instance been introduced, into territory not previously infected, by means of seed. A number of bacterial diseases have been and are still being spread by means of seed, instances being the black rot of cabbage, due to *Bacterium campestre*, the bacterial wilt of maize due to *Aplanobacter Stewarti*, the bacterial blight of cotton caused by *B. malvacearum*, bean blight caused by *B. phaseoli* and other bacterial diseases of legumes, the bacterial chaff diseases of wheat and oats due to *B. translucens*, stripe or streak disease of the tomato and legumes due to *B. lathyri* and the bacterial wilt of many crop-plants due to *B. solanacearum*. After introduction on seed some of these parasites persist in the soil and can be more or less successfully controlled by rotation of crops. The number of parasitic fungi transmitted by seed is much greater, instances being the anthracnoses of beans and cotton caused by species of Colletotrichum, the fusarium wilts of cotton, tomato, cabbage, flax, cucurbits and various legumes, most of the smuts of cereals, stripe diseases of cereals caused by species of Helminthosporium, Diplodia and Fusarium diseases of maize and many other fungous diseases. None of the bacteria pathogenic to plants forms spores, so that they are readily killed by suitable germicides when present externally on the seed coats. It is, however, probable that some are carried within the integuments of the seed and are therefore, not wholly accessible to surface disinfection. The evidence to hand indicates that the bacterial blight of cotton is carried externally so that by suitable surface disinfection cotton seed can be freed from it. A number of the fungous parasites may be present externally as spores or internally as mycelium or spores, so that surface disinfection of seed may give only partial control; this is true of some smuts, the anthracnoses of bean and cotton and the fusarium wilt of cotton, a disease which for some reason is rare in or absent from the West Indies where banana wilt due to a very closely related fusarium is widely distributed. A recent outbreak of fusarium wilt or 'yellows' of cabbage in Trinidad was introduced with foreign seed and doubtless the bacterial blights of cotton and beans and bacterial wilt of tomato have been introduced into the West Indies in the same way. It is also certain that many other bacterial and fungous diseases of cultivated plants have been introduced and are being constantly re-introduced into tropical countries with seed from temperate lands.

Some of the virus or mosaic diseases are now known to be carried in the seed especially the mosaics of legumes and cucurbits. It is by no means certain that the mosaics of some other crops plants are not occasionally transmitted by seed. Mosaic of the Irish potato has not hitherto been regarded as transmissible by the true seed but at the Botanical Conference in London in July Dr. Salaman adduced evidence indicating that about one seed in a thousand from affected plants may carry the virus. In regard to surface disinfection of seed sulphate of copper and formaldehyde have been widely used in practice for many years against bunt of wheat and the smuts of oats and barley. In India even the small cultivators treat the seed of sorghum (jowar) with sulphate of copper against smut; thanks to the initiative of Government this germicide can be obtained in small amounts by the ryots of every village in districts where this grain is grown. Recently, especially in North America the sprinkling or steeping of the grain has been giving place to powdering with dry carbonate of copper an easy treatment which has given excellent control of smuts. The Braun method of pre-soaking in water before treatment with formaldehyde has overcome the reduction in germination of seeds sensitive to its vapour such as wheat. Quite recently the chemical manufacturers in Europe aided by their research chemists have offered to the farmer a number of new and powerful seed disinfectants among which uspulun and germisan have been widely tested and reported on favourably. Seeds which carry infection internally present a more difficult problem. In the case of certain cereal smuts which are carried by the seed as internal mycelium the Jensen hot water treatment developed many years ago has proved an effective control; this treatment takes advantage of the fact that the embryo is more resistant to heat than the mycelium of the fungus. Some seeds can be effectively disinfected by dry heat at atmospheric pressure usually at the cost of reducing germination appreciably. It has, however, been shown that cotton seed if thoroughly dry retains its viability unimpaired when exposed to a temperature of over 100° C. in a vacuum or in an atmosphere of an indifferent gas such as nitrogen or argon; in the presence of air the oil is oxidized at high temperatures and germination prevented. Even at tropical temperatures cotton seed rather rapidly loses in vitality unless it is dried well and stored in a dry place. It is evident that seed disinfection is now receiving greatly increased attention and that effective and practical means will be found of rendering innocuous most of the more injurious infections transmitted on or in seed.

THE TROPICAL WORLD.

Sierra Leone.

The Annual Colonial Report for Sierra Leone during 1923 (No. 1219) reviews the progress made in the Colony during that period. The general improvement in the stability of the European market reacted favourably on local trade with the result that whereas on January 1st, 1923, the Colony's cash account with the Crown Agents was overdrawn to the extent of £69,000, on December 31st, 1923, there was a credit balance of £83,000 on the same account. In 1921 and 1922 all forms of indirect taxation had to be increased to a point where any further addition would have had a disastrous effect upon the trade of the Colony, while many desirable activities of the Government had to be abandoned. In 1923 it was found possible to introduce some relief in taxation by abolishing the export duties on palm oil and gum copal in November, and reducing the *ad valorem* import duties on all kinds of foodstuffs from 25 per cent. to 12½ per cent. In addition the reduction of personnel was arrested and the constructive policy of the Agricultural Department was assisted by the appointment of several additional experts, while certain public works of importance were taken in hand. It is gratifying to note that although the price paid in the European market throughout the year for palm kernels was only moderately good, the value of the actual total export of kernels from Sierra Leone was greater in 1923 than in any previous year during the history of the Colony. The situation in general indicates that the worst of the Colony's financial troubles have been passed, and that with reasonable economy there is no danger of a return to that economic depression from which she is now recovering. Another interesting feature has been the number of economic investigations and enquiries carried out by the Government officers in conjunction with the Imperial Institute and commercial experts. Samples of coffee, cacao, rice, ginger, lime juice, chillies, palm oil, castor seed, cotton, tobacco and other products were sent and reported upon. It was found that the tobacco and rice were unsuited to the market in the United Kingdom and on the Continent. Cacao, prepared in the Southern Province, was composed of small to medium sized beans of the Forasteri variety, imperfectly fermented and of low quality. If properly fermented and dried it should realise the same price as cacao of a similar nature imported from Nigeria and the Gold Coast. Of two samples of ginger one was described by merchants as being of better quality than any other African ginger previously received. The chillies were of fair quality but the market was reported to be limited. Lime juice, palm oil and castor seed were said to be of satisfactory quality. It is pleasing to note that, although the immediate results achieved have been small, the local authorities are fully aware of the desirability and possibility of introducing new commercial commodities.

Fiji.

Mr. Henry Marks, C.B.E., in proposing the toast of the "Colony of Fiji" at the annual dinner of the Fiji Fellows of the Royal Colonial Institute (See *United Empire*, Vol. XV (New Series) No. 10), gave an interesting account of the condition and needs of that Colony. While the Colony is free from serious diseases and has fertile lands awaiting development, difficulties are experienced in securing an adequate supply of labour. The main requirement of the Colony is however an ample supply of capital, and with that secured Mr. Marks believes that all other difficulties would gradually disappear. While he welcomed just criticism in the Press he regretted that many anonymous contributions portrayed the Colony in an unfavourable light, and tended to create an erroneous impression among those reading such articles. He believed that the opinion expressed in a newspaper that, "there is a general feeling that Fiji has come safely through the worst of the slump and that we are beginning to get on to the up grade again," was correct, and as a proof of this he cited the steady and regular increase in the exports. The chief export of Fiji is sugar, and the cost of production probably exceeds £10 a ton so that in 1916 the Colonial Sugar Refining Company alone, which exported 110,000 tons, must have expended over £1,000,000 in the Colony. The aftermath of the Great War resulted in reducing the production of this Company to 35,000 tons in 1923, with a corresponding reduction in the amount spent in the Colony on its production. This, in conjunction with the decline in the production of other crops, dealt a severe blow to general prosperity, similar to that experienced in many other parts of the world. The position to-day is more reassuring, for the estimated export for 1924 is 58,000 tons, and for 1925 probably more than 65,000 tons, and there appears no reason why the exports should not, in the near future, exceed those of 1916. The labour difficulty has of course to be overcome, but with greatly improved mechanical appliances, and an increase in the pay of the unskilled labourer this difficulty would probably be overcome.

Turning to Copra, the next important item on the export list, he stated that in 1922 the quantity exported was 21,987 tons, with a value of £346,000, while in 1923 the exports amounted to 24,161 tons with a value of £443,645, representing a very considerable increase. He estimated the exports for 1924 at 27,000 tons with a value of £594,000, representing a record for Fiji both in regard to quantity and value and, bar exceptionally bad conditions, the 1925 crop should reach 28,000 tons. The report on the recent shipment of cotton from Fiji to London was so satisfactory that cotton exports will soon, in all probability, considerably help to swell the value of trade. He referred also to the possibility of establishing an important export trade in pineapples, provided sufficient capital became available. The banana industry has suffered severly on account of the

prohibitive tariff raised against its importation by the Commonwealth of Australia, and unless this duty is removed, or new markets found, there seems little prospect of the renewed prosperity of the industry. The exports of the two principal products for 1924 were expected to exceed those of 1923 by over half a million sterling, indicating that the Colony was beginning to enter upon a new period of prosperity.

The Philippines.

In the *Philippine Agricultural Review* (Vol. XVII No. 2, 1924) Mr. P. J. Webster gives an interesting account of the manufacture of Copra in the Philippines, where coconut growing is one of the most important industries. In 1922 about 422,284 hectares were planted with coconuts giving a total production of nearly one and a half million nuts, the greater part of which was made into 351,151 tons of copra valued at ₱44,000,000 in round figures. Coconut products are exceeded only by rice and sugar, while among exports they take first place with copra, copra meal and coconut oil exports totally ₱62,100,000. The number of trees planted has practically doubled during the last ten years. It is an unfortunate feature of the trade, that, while the Islands form one of the principal producers of copra in the world, the prices realised are of the lowest, due to the poor grade of copra produced, in consequence of insufficient and faulty drying and handling. More than one half of the copra was *tapahan* dried in 1922, a correspondingly smaller part was sun dried, and only less than ½ per cent. was dried on modern driers. Attempts have been made to induce the planters to improve the methods of drying, and good driers have been installed upon a few plantations, but little or no improvement is noticeable among the rank and file. The individual holdings are usually small, and exporters and millers are unable to pay higher prices for superior copra in *small* lots. While the majority of the planters remain indifferent to the production of better copra, little encouragement remains for those who realise the losses incurred by the production of low grade copra, to improve the quality of their own output. What is required is concerted action by the majority of the planters in a district to introduce improved methods upon a scale sufficient to demand recognition by exporters and millers of local copra. Until that is done, or unless large plantations can produce in such a bulk as to be able to ship in, say, one thousand ton lots, little improvement in the relative general price can be expected.

Sudan.

Much interesting and useful information is to be found in the *Annual Report* of the Director, Commercial Intelligence Branch, Central Economic Board, Sudan Government for the year 1923-24. Undoubtedly the most important event has been the progress made in the construction of the Makwar Dam in connection with the Gezira Cotton Growing Scheme. The Dam is situated 170 miles south of Khartoum in the Blue Nile, near Sennar, and a successful start has been made on the most difficult part of the operations, viz.: the "sudding of the deep eastern channel." Considerable progress has been made in canalising the area to be irrigated and it is expected that the scheme will be completed in time for the 1925 to 1926 cotton crop. The Imperial Government has guranteed the principal and interest of loans to a total value of £13,000,000. The immediate aim is to irrigate 100,000 acres, which it is estimated will yield 80,000 to 100,000 bales of lint. Since the Dam commands an area of 3,000,000 acres the scheme is capable of very considerable extension. The statistics given in the *Report* indicate the immensity of the project. The Dam will be nearly 2 miles in length while the reservoir above the Dam will be a lake some 50 miles long with a capacity of 140,000,000,000 gallons of water. The masonry of the Dam will weigh nearly one million tons while the iron work will weigh about 3,300 tons. The total length of canals is 3,697 miles and field channels 5,589 miles on a total length of 9,286 miles. The cotton scheme will be worked by the Sudan Plantations Syndicate in co-operation with the Sudan Government and the native cultivators.

The quantity of cotton exported during 1923 was 248,365 bales (of 400 lb.) of lint, being the largest on record and representing an increase of 3,816 bales over 1922 and nearly 9,000 bales more than the annual average for the period 1911-23. The value of the lint exported in 1923 amounted to £460,000 and in addition 9,323 tons of cotton seed were exported valued approximately at £70,000. The estimated area under cotton in 1923 was 63,928 acres, comprising 6,381 acres of rain land, 26,016 acres under artificial irrigation and 31,531 acres of flood land. This area represents a decrease when compared with 1922, due to the deficient Baraka flood at Tokar, the area flooded and cultivated being only 22,000 acres or half that flooded in the previous years.

Another highly important development has been the completion of the railway to Kassala in the eastern Sudan, which has been constructed to assist in the development of cotton growing in the delta formed by the inland river Gash near the town of Kassala. It should also assist in the general development of other products in the eastern Sudan where progress has hitherto been retarded by the general absence of transport facilities. The railway will be operated by the Sudan Government Railway Department under contract with the Kassala Railway Company, and will eventually become the property of the Sudan Government. The cotton growing scheme will be undertaken by the Kassala Cotton Company, which is closely allied to the Sudan Plantation Syndicate. A fuller account of the report is to be found in the *Bulletin of the Imperial Institute* Vol. XXII, No. 3, 1924 from which this note has been taken.

Gold Coast.

In a later issue of this Journal we shall print an article on "New Crops for the Gold Coast." In this connection it is interesting to note that in October last the first shipment of hemp was made from this Colony. The climatic conditions of the coastal belt of the Gold Coast appear to be extremely well suited to the production of the finest sisal and it is possible that in a few years time this area, which has previously been unproductive, may support a flourishing industry. The plantation, comprising 1,000 acres, on which the hemp was produced, is situated near Accra and was begun as an experiment in 1920. The plantation is equipped with an up to date factory for extracting the fibre. The cost of production during September amounted to £18 per ton and the transport charges to England another £3 to £4. It should be noted, however, that the cost of production will probably fall as the first cuttings yield the smallest leaves while the cost of reaping and milling is the same as for the larger leaves. The present prices for sisal are very high, varying from about £40 to £45 so that a profit of between £18 to £27 per ton is thus being made, which is sufficient to pay the interest on the outlay, to form a sinking fund, and to cover depreciation, and at the same time to give a very handsome net profit. Normal prices vary between £30 to £35 per ton and even of prices fell to £30 a good profit would still be secured. Since the Gold Coast is situated nearer to European markets than any other sisal growing district in the world the transport is correspondingly cheaper. *The Times Trade and Engineering Supplement* crorrespondent is of the opinion that a large industry can be created and maintained especially when this product of the Gold Coast becomes better known and appreciated.

India.

The London Chamber of Commerce Journal (Vol. XLVIII. No. 562, 1924), contains an interesting account of the Lloyd (Sukkur) barrage and canals project in the province of Sind, India, on which operations recently commenced. The scheme has been described as the greatest irrigation project in the world, and consists of a barrage or dam at a point 3 miles below Sukkur, to span the River Indus which flows through the Sind Province, and in addition seven great new canals. The Province itself is about 350 miles long from north to south, and varies in width from 120 to 250 miles. Of the total area of 30 million acres about one-half consists of cultivable soil, and 50 per cent. of the total population of 3,280,000 depend upon the land for existence. The rainfall in Sind averages only about 5½ inches annually, the greater part of which comes in July and August, and in years of copious rainfall 70 per cent. of the crops are raised by irrigation, and in years of low rainfall about 99 per cent. It will be seen that irrigation is therefore of paramount importance to the agricultural life of the Province. The barrage itself will be nearly a mile in length and its gates will provide for a flow of 1,500,000 cubic feet per second. The combined lengths of the main canals will total 805 miles, of the branch canals 766 miles, and of the distribution system 3,724 miles. The areas commanded will total 8,132,000 acres of which it is expected about 5,500,000 acres will be cultivated. The construction of the barrage will represent a cost of approximately 75,000,000 rupees and the canals 145,000,000 rupees. It is estimated that the ultimate annual net revenue to be obtained from the project after paying working expenses will amount to 19,400,000 rupees, which if realized, will represent a substantial return on capital invested. In addition to this direct revenue, there will be the increased production and wealth of the Province and of India as a whole. It is anticipated that over a period of thirty years increased agricultural production in Sind will enable that province to export about 1,300,000 tons of produce annually, as compared with an approximate surplus for export of 200,000 tons at present. Of the anticipated exportable surplus it is estimated that 950,000 tons will consist of wheat and barley, 160,000 tons of rice, 150,000 tons of cotton, and 75,000 tons of oil seeds.

Louisiana.

From recent issues of the "*Louisiana Planter*" and from other sources, we learn that Louisiana is suffering from a prolonged drought, which is having a very disastrous effect upon its agricultural products, and particularly upon the cane crop. Weather statisticians claim that is the longest period of drought for over ninety years.

The cane has had practically no water and as irrigation is not carried out in Louisiana the crop is literally drying up. Although the canes are very sweet and rich in sucrose content, they are very fibrous and dry, which makes milling very difficult. The Editor of the Planter suggests steaming the cane before grinding in order to help liberate the sucrose.

A factory in St. John Parish has been making use of its factory pumps, to cover the whole plantation with water, "to facilitate the planting of fall cane." Several factories will be unable to operate, and several others are about to give up grinding, due to the lack of fresh water. Salt water is backing up at high tide into the bayous, and becoming a very serious problem. The entire state is suffering from lack of rainfall, and forest fires are raging in East Baton, Rouge Parish and Livingston Parish. Cattle are beginning to suffer from lack of water, in the rural districts.

A dense cloud overhangs the city of New Orleans, and the whole atmosphere is hazy and foggy. Louisiana is very unfortunate, upon being visited by such a prolonged drought, and as the "*Louisiana Planter*" says, the cane has done very well under the worst conditions and had it not been for the lack of rainfall, a very fair crop would have been harvested.

COTTON GROWING.

Progress within the Empire.

The Third Annual General Meeting of the Empire Cotton Growing Corporation was reported in the *Times* for October 24, 1924. At the meeting Lord Derby, President of the Corporation, who was in the Chair, gave an interesting and instructive address reviewing the present situation, and the development of cotton growing within the Empire during the past year.

The increase in the present season's crop in America over that of last year was likely to afford some relief to the manufacturers in the near future in view of probable increases in the orders from the Continent, even though it was not possible to predict a continuance of this larger output in the future.

The increase in Empire produced cotton was not large enough to affect seriously the world's markets, but when considered in comparison with the crops of previous years it was thought to be very satisfactory, and there seemed to be great hopes of substantial further increases in the future.

In the two years 1917 and 1918, the average output of Empire grown cotton was 64,000 bales; in the next two years the average was 93,000 bales, in 1923-24 it was well over 200,000 bales.

In Australia, the conditions were such that cotton was likely to be grown on small holdings, in rotation with other crops, in a general farming scheme, where the cost of production and the amount of labour available would be the determining factors in the amount produced. Under these circumstances it was essential that only the best quality cotton should be grown and that maximum crops should be produced.

In South Africa the system of European owned farms, worked with hired native labour, was well understood by all parties concerned, and should make possible the cultivation of larger areas of cotton with every prospect of success.

In North and South Rhodesia there are large areas where cotton of good quality could be grown and in Swaziland it was hoped that it would soon be found possible to attract white farmers to settle, but at present suitable land at suitable prices was not available.

The need for better transport facilities in Africa includes the development of railways and better road transport. In connection with railway schemes the need for bridges was strongly stressed; the railway bridge over the Zambesi being described as of vital importance to Nyasaland. Also, it is necessary that freight charges should be kept at the lowest rate possible if cotton from the interior of Africa is to be able to compete with that produced on or near the seaboard.

In the matter of road transport, the Corporation is taking the initiative by supplying caterpillar tractors and trailers for trial on the unmetalled roads which, it is believed, will be improved and consolidated by such traffic.

In the Sudan the progress made during the year, and the cotton outlook for the future, were encouraging although the political situation is obscure. The progress made on the construction of the Makwar dam had been steady and continuous, and the completion of this great work would make it possible to plant greatly increased areas under cotton.

The Governor and Director of Agriculture in Uganda were congratulated on the progress of cotton cultivation in that Protectorate and the Corporation had had much pleasure in supplying ploughs for improved cultivation, and also four of their best students as a reinforcement to the Department of Agriculture.

Lord Derby referred to the retirement of Sir Francis Watts, to whose work in the early years of its existence the Imperial College of Tropical Agriculture owed so much and the appointment of Dr. H. Martin Leake as the new Principal. He expressed appreciation of the facilities for the training of students who had been sent out by the Corporation of whom several had already been appointed to positions in Africa. The Corporation had expressed that appreciation by a continuance of the grant to the College for a period of years, and by subscribing liberally to the Building Fund of the College, in response to the appeal issued by Lord Milner.

In referring to the work of the Corporation and that of the British Cotton Growing Association in Mesopotamia, it was stated that 1,000 bales of good cotton were grown in that country last year, and that there was a prospect of increased production in the coming year.

In summing up, Lord Derby reminded the Corporation that the efforts of that Body and of the British Cotton Growing Association could not be expected to result in miracles being performed, nor could they look for immediate advantages. The production of cotton within the Empire had exceeded expectations during the past 12 months. Not only had more cotton been grown, but there was more prospect of cotton being grown than he had expected.

The President referred to the increased knowledge of the subject, the enlarged staff of the Corporation and healthy co-operation with the Departments of Agriculture. One of the most hopeful auguries, if not the most hopeful, was to be found in the students who had been sent to the cotton growing territories, and if the Corporation did nothing more than to give such training to their young men, it would justify its existence.

Altogether the report would appear to be a most hopeful and stimulating one. The scientific needs for the careful study of the problems as they come to light is being borne in mind, while every effort is being made to meet the practical needs of the manufacturers, and the world at large, by increasing the Empire's crops of cotton as rapidly as may conveniently be done.

PREFERENCE ON SUGAR.

When the Conservative Government was defeated at the polls on the question of Protection in November, 1923, it was anticipated that the preference given to Empire sugar would be abolished. To a large extent this has been done and the modicum of preference which remains is considered too small and too precarious to warrant any considerable extension of cultivation within the Empire. With the purely political aspect of the question I am not at the moment concerned, and I propose to deal solely with the economic aspect of the question in so far as it affects the production of sugar within the Empire, and particularly with the problem of securing an adequate supply for the market in the United Kingdom. I consider it an unfortunate feature of English political life that this problem should have become a bone of contention between the various political parties, and the mention of political parties is merely incidental.

In reviewing the situation there are several important facts that we should bear in mind. The first is that the United States of America and the United Kingdom are the two chief importers of sugar. In 1922-23 the United States of America consumed approximately 4,781,000 long tons of sugar and the United Kingdom 1,605,000 long tons. The second is that before the war about four-fifths of the sugar imported into the United Kingdom came from European countries, of which amount Germany contributed nearly three-fifths, Austria-Hungary one-fifth, and the Netherlands one-tenth. Since the war the bulk of the imports consists of cane sugar. The third is, that the United States of America dominates the supply of cane sugar in the United States of America, Cuba, Hawaii, the Philippines, Haiti and San Domingo, Porto Rico and Mexico; all countries in which the proportionate increase in the production of sugar has been greater than the average increase in the sugar producing countries of the world. This means that the United States of America controls nearly one-half of the cane sugar of the world. In addition America is endeavouring to secure a financial control over the German production of beet sugar by advancing a credit of $4,000,000 and a movement is on foot to obtain a similar control over the supplies of beet sugar from Czecho-Slovakia. In the event of these proposals materialising America would secure a virtual monopoly of the world's sugar, for the outside sources would be so small that they would have little effect in determining prices. The fourth important fact is that approximately only 25 per cent. of the United Kingdom demand for sugar is met from sources within the Empire and, unless this proportion is rapidly increased, the United Kingdom will find that supplies of, and the prices for, her sugar to a great extent dictated by America.

The fifth is that the British Empire produces only about 4¼ million tons of sugar. India is the greatest producer and also the greatest consumer of sugar in the Empire, so that, in spite of her output of over 3¼ million tons of sugar, she actually has a net import of sugar. This leaves the British Empire, excluding India, with a production of less than 1 milion tons so that even if the needs of the countries of production are ignored, and the *whole* amount became available for export to the United Kingdom, nearly ¾ million tons would have to be imported.

Now what in effect has the United Kingdom done to encourage the increase of sugar production within the Empire? It is, I think, generally agreed that had the proposals for a *stabilised* Imperial preference placed before the Imperial Conference of 1923 by the Conservative Government, been carried out, sufficient security in the home market would have been guaranteed to justify British sugar producers in increasing their production of sugar.

Instead of carrying out these proposals the Government reduced the Imperial preference to a maximum of 1*s*. 11.3*d*. per cwt. We can perhaps best gauge the possible effect which the proposed stabilised preference of the Conservative Administration would have had, by observing the results of the reduction of the 1919 preference. Mauritius which had hitherto exported most of her sugar to India began as a result of the preference granted in 1919 to divert her supplies more and more to England, until, in 1923, she was responsible for 4½ million cwt. of unrefined sugar out of a total of 7½ million cwt. imported into the United Kingdom from the Empire. Since the reduction of the preference, exports are reverting to their former channels. Similarly the West Indies and British Guiana are depending to an increasing extent upon Canada and the United States of America as markets for their supplies of sugar.

So far we have referred only to the diversion of supplies from the United Kingdom to other markets as a result of the reduction of the Imperial preference. This is by no means the most serious side of the problem, for the diverting of supplies does not *necessarily* mean that the production of these countries has in any way decreased. The *real* danger lies in the fact that these, and other countries within the Empire, may, as a result of the reduction, tend to decrease their output instead of increasing it. There can be no doubt that the modification of the preference has resulted in the abandonment of proposed schemes of extension. The immediate effect of the Budget proposals was readily observable in the fate of new companies due to be floated immediately after the publication of the terms of the reduction. The underwriters of the Jamaica Sugar Estates, Ltd., found that they were left with 77 per cent. of their commitments of £250,000 when 400,000 £1 shares were offered to the public. A new appeal is being made to increase the subscribed capital to £350,000 in order to secure the Treasury Loan under the Trade Facilities Act and if this fails to materialise it is feared that this promising new Jamaican project will have to be abandoned. The Company floated in May to take over the Caroni Sugar Estates also met with a

disappointing reception (1). The significance of the failures of these Companies to raise sufficient capital lies in the fact that the public no longer considers sugar producing concerns as profitable fields of investment, and without capital, extension cannot materialise.

Similar instances can be quoted where the preference of 1919 resulted in an increase of production within the Empire. In South Africa the exports increased from 824 short tons in 1917-18 to 40,000 short tons in 1921-22. It is anticipated that the exports to the United Kingdom will decline as a result of the reduction of the preference. In Australia, too, exports increased from 1,347 tons in 1917 to 29,409 tons in 1922 and the expansion of the sugar industry for export has received a check.

It is indeed strange that Parties which objected to preference upon principle should be instrumental in proposing a bounty—hitherto regarded as the most obnoxious means of assisting industry—for the beet sugar industry of the United Kingdom, but, in so far as the proposal is a recognition of the growing seriousness of the situation, there is much to commend it. Yet it is singularly unfortunate that the sugar producers of the Empire, who have recently been labouring under most difficult conditions, should experience this rebuff just at the time when the foreign command of the world's sugar production is beginning to make itself most felt. The proposed beet sugar bounty, contains one other feature which is praiseworthy, namely the fact that a *definite* bounty is suggested for a *definite* period of years, so that those who desire to embark upon this venture, or those who may desire to invest in it, will know exactly what is to be expected from State assistance, and are thus placed in a position to make a fairly reliable estimate of soundness of the proposition.

It is highly essential that producers should know as accurately as possible the assistance, if any, which can be expected from the British Government. With the probable change in the Party responsible for H. M. Government in the United Kingdom following the present election (2) the question of Imperial Preference is likely to be raised again. It is most profoundly to be hoped that the question will be thoroughly threshed out and a definite decision arrived at which will stabilise the position for a definite period of years. The question of preference has too long been the shuttlecock of political parties in the House of Commons, and while this state of affairs exists progress along sound lines is absolutely impossible.

The problem of an extension of cultivation of sugar within the British Empire can be divided roughly into two divisions, namely, the agricultural and the manufacturing factors. While it would be unwise to underestimate the obstacles in the way of an extension of the cultivation of sugar cane, there can be no doubt that this problem can be solved with less difficulty than the problem of the extension of the manufacture of sugar, since the agents necessary for an extension are either ready at hand or fairly easily obtainable. The increase is in fact limited only by the amount of suitable land and labour available. By suitable land is meant land suitable in regard to soil requirements, climatic conditions, within easy reach of the port of shipment, &c. The area of such land is not by any means exhausted and is capable of considerable extension. By suitable labour is meant, either men already trained in the cultivation of sugar-cane, or men who could rapidly become efficient under trained supervision. There already exists a fairly large reservoir which could be drawn upon to meet these requirements, provided the industry is in a position to pay adequate wages. Hence the difficulties in obtaining sufficient land and labour, while appreciable, are not insurmountable, and provided an adequate price could be obtained, supplies of both would soon be forthcoming. Since the sugar-cane is an annual crop the amount of capital required, while considerable, is not very large in comparison with other crops where capital is locked up for a number of years before any return can be expected. The difficulty in the way of securing an adequate supply of cane seedlings, &c., would soon be overcome provided the financial exigencies of the situation rendered a thorough development of the supply profitable.

Assuming then that the difficulties in the way of increasing the supplies of cane are overcome, we are faced with the problem of the production of the sugar, for it is essential that the sugar should be manufactured or partly manufactured, on the spot, since the cane cannot be exported because of its poor keeping qualities. The obstacles in the way of extending the manufacture of the sugar are much more formidable. In the first place the erection of an up-to-date sugar factory involves the expenditure of a large amount of capital. Moreover, this capital is locked up for a long period of years, and an adequate return on this investment can be secured only if the factory is kept running for a number of years. The factory is run only during the cropping season which amounts to about 3-4 months of the year. It is possible, that, by breeding canes which mature during a shorter period, the crushing period can be extended, but meanwhile it will be seen that the factory must be capable of dealing with the maximum output of cane during the short period of 3-4 months. This implies that the overhead charges must of necessity be very high, so high indeed that it is often preferable to run a factory at a loss, in the *hope* of securing a profit, than to allow the machinery to remain idle.

It is, therefore, highly desirable that if a preference is to be given it should be stabilised for a definite period of years in order that companies contemplating the erection of factories may be in a position to calculate the likelihood of securing a profit upon their investment. During the present uncertainty it is absolutely impossible

(1) Later news concerning these Companies is much more reassuring.

(2) Since reported to be an overwhelming Conservative victory.

to do this with any degree of accuracy. It is often argued, usually by people ignorant of the conditions obtaining in tropical countries, that British sugar producers are unable to compete with other sources solely because their factories are not sufficiently up-to-date to produce sugar on economical lines, and that the absence of any preference will stimulate them to introduce more economical processes. The fact remains that up-to-date factories will not be erected unless the investing public is certain that the sugar when produced, will be marketable at a remunerative price. With the possibility of British sugar being completely shut out of foreign markets by hostile tariffs, and with the absence of adequate preference in the home market, this security is not obtained. It is similarly impossible for the proprietors of the older factories to obtain sufficient capital to increase the efficiency of their factories unless they too are certain of a profitable market for their sugar.

It is complained that if a preference is granted to British sugar producers the consuming public will have to pay more for its sugar, and naturally the general public, and more particularly those industries which are dependant upon an adequate supply of cheap sugar as a raw material, object to the possibility of having to pay a higher price. This argument is to a large extent discredited by the proposed bounty on the production of beet sugar in England which will result in the payment of £290,000 from the Treasury during the present financial year, if the estimated yield of 20,000 tons is realised. (see "*Trop. Agri.*" Vol. I. No. 12. p. 191.) The financial effect is much the same as in the granting of a preference, for in one case money is granted *from* the Treasury and in the other case revenue is lost to the Treasury through the importation of sugar at a lower duty. In any case the granting of a subsidy, and the reduction of the duty paid on sugar originating from within the Empire, ignoring other financial effects, do not tend to an increase in the price of sugar to the consumer. The fact remains, however, that if the control of the world's sugar supplies passes into the hands of a small group of foreigners, they will be in a position to determine to a large extent, not only the quantity which the United Kingdom shall receive, but also the price which she will have to pay, and we have had sufficient experience of the cornering of the world's supplies in other important commodities to realise that this means considerably enhanced prices. The price would, indeed, be limited only by the possibility of stimulating other sources of sugar, or the production of substitutes for sugar, or the willingness of the public to go without sugar. We have already indicated the difficulties in the way of providing new sources of supply, and in any event such supplies would take some time to create. In addition the controller of the bulk of the world's supplies would be in a position to flood the market with sugar at prices with which other producers could not compete and so compel them to relinquish the production of sugar. On the other hand we have already seen during the war the difficulties in the way of creating any substitutes in sufficient quantities to take the place of sugar. Sugar must be regarded as a necessity rather than a luxury and the low consumption during the latter period of the war was due, not so much to the high prices, as to the impossibility of obtaining adequate supplies. We are thus forced to the conclusion that, unless the production of sugar within the Empire can be stimulated by a preferential tariff, or by other means, the ultimate control of the world's supplies must pass into foreign hands, with the result that the English consumer would inevitably have to pay higher prices, and those industries in the United Kingdom which are dependent upon cheap sugar would be compelled to close down. The situation is serious and calls for immediate action on the part of the Home Government, and an action not clouded by the acrimony of party politics. The Empire has it in its power to develop a supply of sugar entirely adequate to its needs. It remains to be seen whether use will be made of that power or the opportunity allowed to slip by.

C. Y. SHEPHARD.

REVIEW.

"The Economic Development of the British Overseas Empire 1763-1914" By L. C. A. Knowles, M.A., L.L.M. (Cantab.), Litt. D. (Trin. Coll. Dublin). London: George Routledge & Sons, Ltd. Price 10s. 6d. net. pp. xii+535 with tw maps.

The appearance of a book such as this, at a time when the Empire and Imperial Development are in the minds of large section of the British race owing to the stimulus of the Wembley Exhibition, is most opportune. The lasting effect of that Exhibition is to be found mainly in the business connections established and it is doubtful whether, on the average individual, a visit to the thronged courts leaves anything more than a vague and rapidly weakening impression of the Empire they represent. Something further is required if these vague impressions are to become permanent; something must be known of the origin of that Empire which "comprises one quarter of the globe and over 200 separate items;" which is peopled by races in every economic stage of development from cannibals to rajas, from peasants to factory hands, from pirates and slave traders to merchants and factory hands, and whose "currency has included rods, cowries, rum, slaves, rupees, dollars, francs and the pound sterling" to which list might well be added salt and matches. This something the book supplies in full measure.

How then has the Empire expansion come about? The ways are nearly as diverse as the units and races of which it is composed. There were, however, three marked stages; the earliest ending in 1763 being a period of outposts, usually trading stations, situated on islands and coastal tracts. During the second marked by the acquisition of Quebec and by the grant to the East India Company of the right to collect revenue in Bengal, both indicative of an inland expansion, a certain

pre-eminence is given to the hold on the continental areas of which the fringe only had hitherto been touched. And lastly the third, starting about 1870 with the federation of the Canadian Provinces with Dominion Status, has resulted in the present Empire composed of independent units but yet forming a single world unit. Throughout this period can be traced the gradual change of opinion with regard to overseas possessions; in the earlier stages the struggle is with other European nations for the possession of the wealth of the world, the spices and precious stones of India and the silver of the Inca and Aztec. Later, with an expanding population, the demand is for essential commodities, for wool, cotton and later wheat and oilseeds. The seventeenth century view of the importance of man power, leading to restriction of emigration, changes to the acceptance of colonies as an outlet for population but, since these have to be protected, a *quid pro quo* must be given to the home country in the form of a monopoly of trade. Only after the loss of the American colonies does the view change to the freedom of the open door.

The means by which this development is brought about is shown to be wrapped up in the development of transport. So long as carriage is by human power or even by the beast of burden, trade must be limited and penetration of continental areas slow. Empire development is largely a story of road and rail construction and there is more than a modicum of truth underlying the saying that the first thing a German builds in a Colony is a barrack, a Frenchman a café and an Englishman a road. In Africa especially the abolition of slavery and the attempts to control the slave trade gave a check to penetration until mechanical transport furnished a new means of conquering the interior.

Such briefly are the compelling forces and the methods of building of this Empire but the diversity of the results require further explanation. Here there are two factors at work, the climate and the indigenous population, which make for diversity. Over large areas the climate is equitable and it is possible for the white man to settle and rear healthy children. In such places the emigrant has built his home and taken possession of the land; he has created a second England in a far country. In other areas the climate is ill adapted to permanent settlement by the white man and the development is by other agency though usually organised and financed by them. In both cases the same problems arise though the form and relative importance of these is different. Arising under the former conditions are those problems of population and a labour supply in such countries as Canada, Australia and New Zealand where an indigenous population is vanishing or even entirely lacking; and of the relations of the white settler to the indigenous population in such countries as South Africa and Kenya. Arising out of the latter are those problems of employment of the indigenous labour where such exists as in Nigeria and most of Central Africa and of provision of labour by indenture or otherwise in such countries as the Sudan and British Guiana where the labour supply is deficient. Labour again may exist but it may not desire to work, especially is this the case in Africa. "The real difficulty is that the bulk of negroes have no need to work" and "until the wants of the natives increase enormously it is difficult to see a remedy." The compelling force of slavery has been removed and the problem of development here is to provide an alternative force to produce work which "is part of the discipline of life."

It is such questions which are of especial importance to tropical development. Compulsion may be essential but it is a dangerous force to let loose and the protection of the native becomes one of the pressing functions of the Government. The Dutch have frankly developed their tropical possessions for the benefit of Dutchmen and Holland has always regarded her colonies as a source of revenue to the mother country. If they have used the native customs and have not interfered with the religions, that is merely incidental. The French have adopted a process of assimilation under the false belief that human nature is fundamentally the same regardless of race; the German system was "frank military despotism, merciless despotism under the lash." The British system falls between the French and Dutch; it recognises the French as the ideal while it falls short of the Dutch inasmuch as revenues are applied for internal development. That it is possible to proceed too fast in these directions and that the primary object should be to make the native a diligent worker rather than to feed him with ideals are views that are daily receiving wider acceptance.

It is here that tropical development is at the cross-roads. Improved means of transport are now opening up large tracts hitherto inaccessible; the demand for tropical products stimulated by the rapid increase in the general standard of living is likely to push development in the more recently opened areas too fast. The difficulty of obtaining work from those who have few wants easily satisfied and who have merely to walk out, burn a small area and plant a few seeds tends in the direction of alienation of the land and the development of a plantation system. The desirability of this development is very questionable where there is a population holding a definite, though slight, hold of the land. The sounder development is through the local system of land tenure and here it becomes a question of the instillation of desires to stimulate work and of the provision of capital, for "if the small agriculturist is to take up any commercial crop he must be provided with capital, either to wait until the crop is grown or to buy the new tool or manure." Though it is doubtful if full agreement will be given to General Smut's conclusion on the German system, based on a systematic discouragement of white settlement, that, "harsh as it undoubtedly is—it is, perhaps the more scientific one, and in the long run it is the more profitable form of exploiting the tremendous natural resources of the tropics," there can be

little doubt that the plantation system is not always sound and that a tenancy system is, under certain conditions, advantageous.

It is not possible to follow the book further into the ramifications of Education, Finance and Medicine. It is stimulating to a degree and should be widely read by all interested in Empire Development. The devotion of the first volume to the larger tropical areas of the Empire should make a special appeal to readers of the Journal. Especially is the section on British India worthy of close study, for the English have been in India from the earliest days of the expansion ; they have there met an ancient civilization, they have had a wider experience of systems of land tenure and of administration than elsewhere, and they have made their failures as well as their successes. A study of these failures would go a long way to ensure future successes.

On one point only does the book not satisfy. With such a record of achievement in the development and uplift of the standard of life among the various races of the Empire it is a matter of wonder why these races so often exhibit discontent and hostility to the people who have done so much for them. This lack of satisfaction is no criticism for the point lies entirely outside the scope of the work rather is it to the credit of the author that her work stimulates such thought.

H. MARTIN LEAKE.

SOUTH AFRICAN COTTON.

Marketing in Europe.

To the *Journal of the Department of Agriculture* (Union of South Africa) Vol. IX No. 3, 1924, Mr. T. G. Hesse, Government Cotton Grader, contributes an instructive article on the Marketing of South African Cotton in Europe. Our readers will remember that for a number of years, practically since 1902, European cotton manufacturers have increasingly realised their unenviable position in having to rely mainly upon the United States of America for the supply of their raw material. The situation has been rendered critical by the fact that, although the world demand for cotton has been increasing, the production in America has been decreasing, and that, coupled with the increasing internal consumption in America, has left less cotton available for export to Europe. As a result, European countries, and particularly England, are showing keen interest in all new cotton-producing areas, and endeavouring to foster the production of cotton within the borders of their own colonies and dependencies. Consequently cotton growing is being attempted in most of the suitable areas of the world, but sooner or later, when cotton prices decline to lower levels, those areas with the highest costs of production will have to be abandoned. Under such conditions efficient methods of marketing are of the greatest importance. The South African Government was fully alive to this necessity and undertook the grading of cotton in 1921 and made it compulsory in 1923. The objects were, briefly (1) to give the farmer, owner or ginner of the cotton a reliable basis on which to determine its value by supplying him with its commercial classification. (2) To establish types of South African cotton, and by carefully adhering to these types in the classification and shipments, to establish them on the overseas markets and to foster a system of marketing most advantageous to the grower. (3) To avoid mixed packing and to assist in the growing of even-running cotton. In general the idea and the system met with a favourable reception but it was indicated that complete confidence had not been established in the types and shipments, since a few instances were brought to light in which the classing and stapling were not considered sufficiently even. On the Continent, however, all parties declared themselves satisfied with the system as well as the grading.

The introduction of the 1924 universal standards, which came into force on August 18, 1924, in all markets dealing with American cotton made a revision of South African types necessary. A careful study of the new standards was made and will be taken as a basis on which local graders can work. The method of grading staples hitherto employed had been different to that used in Liverpool. Owing to the small quantity coming up for grading and the absence of distinctive character in the small lots, " actual length " stapling was used with the result that characters of strength, body, &c., were not given the same consideration as in Liverpool. Since the chief market for South African cotton is centered in Liverpool and the Liverpool standards are understood on the Continent, arrangements were made during 1924 to effect the small changes necessary to meet these requirements.

Mr. Hesse makes some justifiably strong comments upon the effect of mixed packing. While the shipments of many ginners were completely satisfactory, others were very faulty in this respect and it cannot be too strongly emphasized that such methods entirely exclude confidence. It has been repeatedly pointed out that bales are graded and valued according to the lowest grade of cotton they contain, irrespective of quality. Mixed packing is irritating to the spinner and results in a heavy loss to the seller. Satisfaction was general among buyers at the attempt to introduce a standard bale, because it simplifies and standardizes their calculations regarding freight, handling charges, warehousing, and particularly weight, and avoids petty annoyances and irritating difficulties.

The general recognition of the great improvement in the style, evenness, and shipments of South African cotton is a matter of satisfaction. The difficulties connected with a more restricted and exacting market for long staple cotton are appreciated and it is agreed that the growing of such cotton should be approached with caution.

COLLEGE NEWS.

The College vacation extends from December 20th, 1924, to January 4th, 1925, during which a vacation excursion will be made to St. Vincent by some of the Post-Graduate students.

On November 13th, Mr. J. M. Thomas, Vice-President of the Federation of Master Cotton Spinners' Associations and Chairman of the Finance Committee of the British Cotton Industry Association, accompanied by his daughter, paid a visit to the College.

Major W. B. Gray, M.A., Commissioner of Education for British Guiana and Mr. E. Wynne Williams, Divisional Inspector of Schools, England, visited the College.

Sir E. Davson, Governor of the College, visited the College and the Sugar Factory on November 15th, and attended a meeting of the Executive Committee on November 17th.

A meeting was held at the College recently at which Mr. T. A. Twyman representing the Montserrat Company met the Principal and Members of the College Staff and of the Trinidad Department of Agriculture, and Sir Francis Watts, late Commissioner of Agriculture for the West Indies, to discuss the situation of the lime industry at Montserrat.

On Friday, November 7th, at a meeting of the Trinidad Field Naturalists Club, Dr. C. L. Withycombe delivered a lecture with lantern slides illustrative of the life histories of certain insects. Those of interest to the planter included the coconut moth, which has defoliated palms at Golden Grove Estate this year to a serious extent; the lacewing flies, the larvae of which are valuable checks upon scale insects, aphids, &c.; and the leaf cutter bee, which removes curved pieces of leaf from rose and other trees in order to construct its nest. The damage done by this insect is often wrongly attributed to leaf cutting ants.

Sir Arthur Shipley, Chairman of the Governing Body of the Imperial College of Tropical Agriculture, recently delivered a lecture on "The Development of Tropical Agriculture in the West Indies," before members of the Royal Colonial Institute in which he dealt with the diseases of plants, their causes, prevention and cure. Sir Arthur referred to the work of the Imperial College of Tropical Agriculture in this connection.

On Friday evening, November 15th, Professor Dash addressed members of the staff, students and friends on various problems of agricultural interest, arising from his attendance at the Toronto meeting of the British Association for the advancement of Science last August. He also exhibited lantern slide views of the Macdonald Agricultural College, McGill University, which the Association visited on one of its excursions. The Principal presided at the lecture which was held under the auspices of the Students Union.

Dr. W. C. Hausheer of the Rockefeller Ankylostomiasis Commission, delivered during November last a course of three lectures upon Hookworm disease, with special reference to its essential bearing upon agricultural practice. He showed that the problem was rather a sociological than a medical one, and as such it demanded the attention of all who desired to take up agriculture as a profession. His lectures were illustrated by lantern slides, patients infected with hookworm, and living specimens of the worms.

At a General Meeting of the Trinidad Agricultural Society, Professor S. C. Harland, D.Sc., F.L.S., delivered a lecture on "Some Problems of the Cacao Tree from the Botanical standpoint." The lecturer first gave an account of his experiments on the pollination of cacao, and stated that red ants and aphis appeared to play an important role in Trinidad. About 1 per cent. of flowers were pollinated by some unknown night flying insects. The factors influencing productivity in cacao trees were discussed in some detail, and a plea was put forward for co-operation between botanist and manufacturer on the question of quality.

The four New Post-Graduate students mentioned in our last issue have been nominated by the Colonial Office for a year's course at the College, and will afterwards proceed to the Gold Coast as Assistant Superintendents of Agriculture.

Mr. B. T. Steemson, was educated at Worksop College, Notts., and Brasenose College, Oxford, where he obtained his B.A., in Agriculture.

Mr. W. T. O. Maidment was educated at Cheltenham College and Selwyn College, Cambridge where he obtained his B.A., in Agriculture.

Mr. J. C. Muir, B.Sc., N.D.A., N.D.D., was educated at Allan Glen's School, Glasgow University and the West of Scotland Agricultural College.

Mr. F. A. Robb, B.Sc., N.D.A., was educated at Butcheson's Grammar School, Glasgow University and the West of Scotland Agricultural College.

The College A. F. C. XI, has succeeded in reaching the semi-final of the Clydesdale Cup Competition by defeating St. Mary's College 2nd XI, 5-1, and the Constabulary XI, by 3-2. In the semi-final the College is to play the winner of the Queen's Royal College XI *v.* Hotspurs XI match.

On Saturday, December 6th, the Post-Graduates met the Diploma Students in a tennis tournament in which one set of doubles was played by each pair. The results were as follows:—(*1st pair*) Mr. W. C. Lester-Smith and Mr. W. T. O. Maidment (Post-Graduates), lost to Mr. S. H. Evelyn and Mr. J. A. McDonald (Diploma Students), 6-3. (*2nd pair*) Mr. J. B. Hutchinson and Mr. J. W. Cowland (Post-Graduates), lost to Mr. H. B. Springer and Mr. D. R. D. Wiles (Diploma Students), 6-4. (*3rd pair*) Mr. J. E. Peat, and Mr. B. T. Steemson (Post-Graduates), lost to Mr. P. D. R. Bovell and A. H. McInstry (Diploma Students), 6-0.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR :—Sugar futures are somewhat lower since the estimated beet returns prove to be of a conservative nature.

COTTON :—A number of "bullish" factors tended to a decline in the price of cotton which fell from 15·20*d.* per lb. spot on October 6th, to 13·20*d.* per lb. on October 27th, but afterwards rose to 15·75*d.* on October 30th. Subsequently there was another fall to 13·25*d.* on November 3rd. Since then the Bureau's estimated crop of 12,816,000 bales, which indicated that, in spite of the good weather crops would not be materially larger than generally expected, the general improvement in the political situation, and an improvement in consumption resulted in a hardening of prices which rose to 13·70*d.* per lb. on November 13th, for Mid-American. The general outlook would appear to indicate a further advance in the near future.

COCOA :—Cocoa has again improved in price since our last issue, rising rapidly to 18 cents per lb. for Trinidad Cocoa in New York, and to 85-90*s.* per cwt. London, and has hovered about those prices ever since, 17¾ cents and 85*s.* to 88*s.* respectively being paid on December 6th.

COFFEE :—After October 8th, all grades of coffee continued to rise, ordinary Santos reaching 118*s.* per cwt. on October 28th and Mysore Middling 150*s.* Prices then fell a little for most grades of coffee, Santos falling slightly to 116*s.* on November 12th, while Mysore Middling after a short relapse again closed at 150*s.* on the same date.

TEA :—Prices for tea continued to rise until the October 15th, when Ceylon Average fetched 24½*d.* per lb. Indian 23¼*d.* and Java 19¾*d.* Since then the tea market has been irregular but showing in general a slight decline. Averages on November 13th, were Ceylon 23·35*d.* Assam 23·02*d.* Indian 21·62*d.* Java 18·31*d.* per lb. London. Stocks on November 18th were declared at 135,353,800 lb. of which not more than half is Indian.

SISAL AND HEMP :—Since October 8th, prices for both sisal and hemp have declined to £50 and £54½ per ton respectively, but the outlook is very uncertain and arrivals go quickly into use.

RUBBER :—On August 20th, rubber touched 13¼*d.* per lb., but reached 18*d.* per lb. on November 12th. While representing a considerable improvement there is not the same satisfaction that there would be if rubber were a free market, and present drices are considered none too firm.

RICE :—Burmese rice rose from 17*s.* per cwt. on October 8th, to 19*s.* on November 12th, but Carolina remains steady.

COPRA :—Copra represented a good market at the end of October, Ceylon reaching £33 10*s.* per ton and Malabar £33, on October 22nd. Since that date there has been a general decline, Ceylon falling to £32 10*s.*, but the market generally remains strong.

OILCAKE :—Oilcake constitutes rather a dull market, linseed fetching 13*s.* 9*d.* per cwt., cotton seed 8*s.* 7½*d.* and coconut 12*s.* 7½*d.* on November 12th.

FERTILIZERS :—Sulphate of ammonia, sulphate of potash, muriate of potash are in somewhat increasing demand reaching 14*s.* 9*d.*, 11*s.* 3*d.*, and 7*s.* 3*d.* per cwt. respectively for concentrated grades.

THE COCOA MARKET.

After a long spell of low and unprofitable prices cocoa has suddenly shown considerable improvement and whereas Trinidad cocoa fetched only 7½ cents a lb. in New York in November, 1923, it now fetches 18 cents per lb. (December, 1924). This remarkable improvement is due largely to the unexpectedly firm attitude adopted by West African shippers who continued to demand higher prices and temporarily even withdrew offers altogether. The restricted offer of better grades of cocoa such as Ecuador, Trinidad and Venezuelan caused already enhanced prices to climb still higher. World stocks which appeared very large a short while ago seemed to have disappeared. The following table compiled by Messrs. C. Tennants Sons & Co., Ltd., London, shows a comparison between stocks on November 7, 1923 and 1924.

	1924 *Stocks.* *Bags.*	1923 *Stocks.* *Bags.*
Liverpool ..	175,348	315,658
London ..	93,315	126,248
New York ..	127,051	257,729
Bordeaux ..	20,537	58,126
Havre ..	45,446	131,810
	462,297	889,571

This table shows that compared with last year, stocks on November 7th, revealed a shortage of 420,274 bags. World consumption seems to be increasing while supplies seem below normal.

During the first three weeks of October prices jumped upwards daily but on the 21st prices broke suddenly, Accra falling 2*s.* For several days prices rose and fell erratically but after a few days of calm, during which little cocoa changed hands, there was a steady revival in the price of new crop Accra and the market resumed a firmer tone. The immediate general outlook seems to be a favourable one for producers but with the more distant prospects we hope to deal more fully in a later number of the Journal.